



2007 PNE/AEROSE-III Cruise Summary

Trans-Atlantic Aerosol and Ocean Science Expedition

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Beltsville, MD
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With special thanks to...

- **Tom Pagano and the AIRS Science Team**
- **M. Szczodrak , K. Voss, M. Izaguirre (UM/RSMAS)**
- **Dan Wolfe (NOAA/OAR/ESRL/PSD)**
- **A. Flores, C. Stearns, I. Renta , T. Maldonado, S. Melaku (HU/NCAS), J. Escalera, M. Vazquez (UMET)**
- **W. Wolf (NOAA/NESDIS/STAR)**
- **C. Dean, L. Zhou (PSGS)**



Participating Institutions

- **Howard University NOAA Center for Atmospheric Sciences (HU/NCAS)**
- **NOAA/NESDIS/STAR – Perot Systems Corp.**
- **University of Miami/RSMAS**
- NOAA/OAR Atlantic Oceanographic and Meteorological Laboratory (AOML)
- NOAA/OAR/ESRL/PSD (formerly NOAA/ETL)
- NOAA Pacific Marine Environmental Laboratory (PMEL)



Key Onboard Collaborators

NAME	INSTITUTION	RESPONSIBILITY
R. Lumpkin C. Schmid	NOAA/AOML	Chief Scientist; TAO Moorings; CTD, XBTs
V. Morris E. Joseph Grad Students	HU/NCAS	Aerosols; Chemistry; Radiation Budget; Ozonesondes
N. Nalli	PSGS NOAA/NESDIS/STAR	Sondes and AIRS/IASI Validation
D. Wolfe	NOAA/OAR/ESRL/PSD (formerly NOAA/ETL)	Vaisala sounding system; Surface Flux Measurements; C-Band Radar; Wind Profiler; Sea Space Satellite Uplink
M. Szczodrak M. Izaguirre	UM/RSMAS	M-AERI Observations; Micropulse Lidar; MW Radiometer; All-sky camera



Key Shoreside Collaborators

NAME	INSTITUTION	COLLABORATION
M. Goldberg C. Barnet J. Wei W. Wolf	NOAA/NESDIS/STAR PSGS	AIRS Data and Retrievals
P. Minnett K. Voss	UM/RSMAS	M-AERI Data; All-sky camera Micropulse Lidar
S. DeSouza-Machado L. Strow	UMBC	AIRS/M-AERI Radiative Transfer Modelling
T. Pagano	JPL	RS92 validation rawinsondes



AEROSE Overview

- The **Aerosol and Ocean Science Expeditions (AEROSE)** are a series of trans-Atlantic intensive atmospheric field campaigns conducted aboard the NOAA Ship *Ronald H. Brown (RHB)* (Morris et al. 2006).
 - AEROSE-I (March 2004; 4 weeks)
 - AMMA/AEROSE-II piggyback (June-July 2006)
 - Leg 1 (4 weeks)
 - Leg 2 (4 weeks)
 - PNE/AEROSE-III piggyback (May 2007; 4 weeks)
- AEROSE has sought to obtain a suite of complementary measurements to study the transport of aerosols from the African continent across the Atlantic Ocean, including
 - Microphysical evolution and regional impacts
 - Regional atmospheric chemistry and marine meteorology



AEROSE Goals

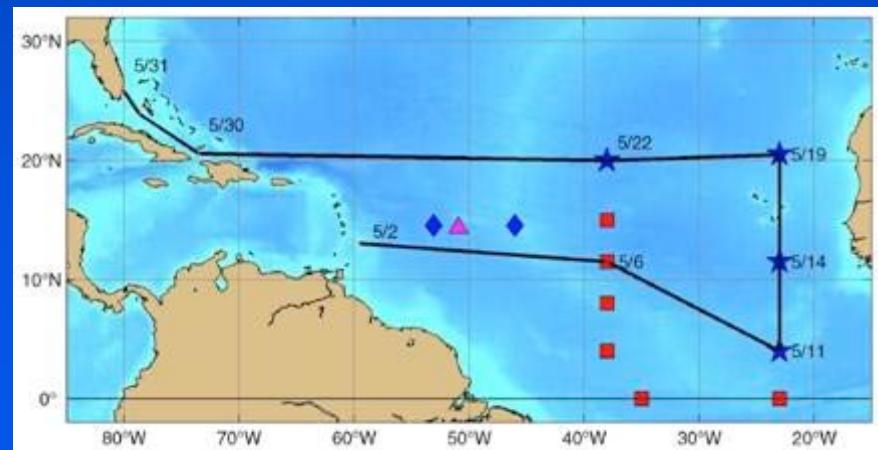
The three central scientific questions being addressed by AEROSE are (Morris et al. 2006; Nalli et al. 2006)

1. What is the extent of change in the mineral dust and smoke aerosol distributions as they evolve physically and chemically during trans-Atlantic transport?
2. How do Saharan and sub-Saharan aerosols affect the regional atmosphere and ocean during trans-Atlantic transport?
3. What is the capability of satellite remote sensing and numerical models for resolving and studying the above processes?



PNE/AEROSE-III Cruise Snapshot

- 2nd piggyback sub-mission on a **NOAA PIRATA (Pilot Research Array Tropical Atlantic) Northeast Extension (PNE)** buoy deployment cruise
- NOAA/AOML allocated ship time for 30 days during May 2007. The primary objective of the main mission was to extend the Atlantic PIRATA moored array
 - Conduct hydrographic line along 23°W
 - Recover/redeploy at 4°N and 11.5°N
 - 2 new moorings deployed at 20°N (23°W and 38°W)

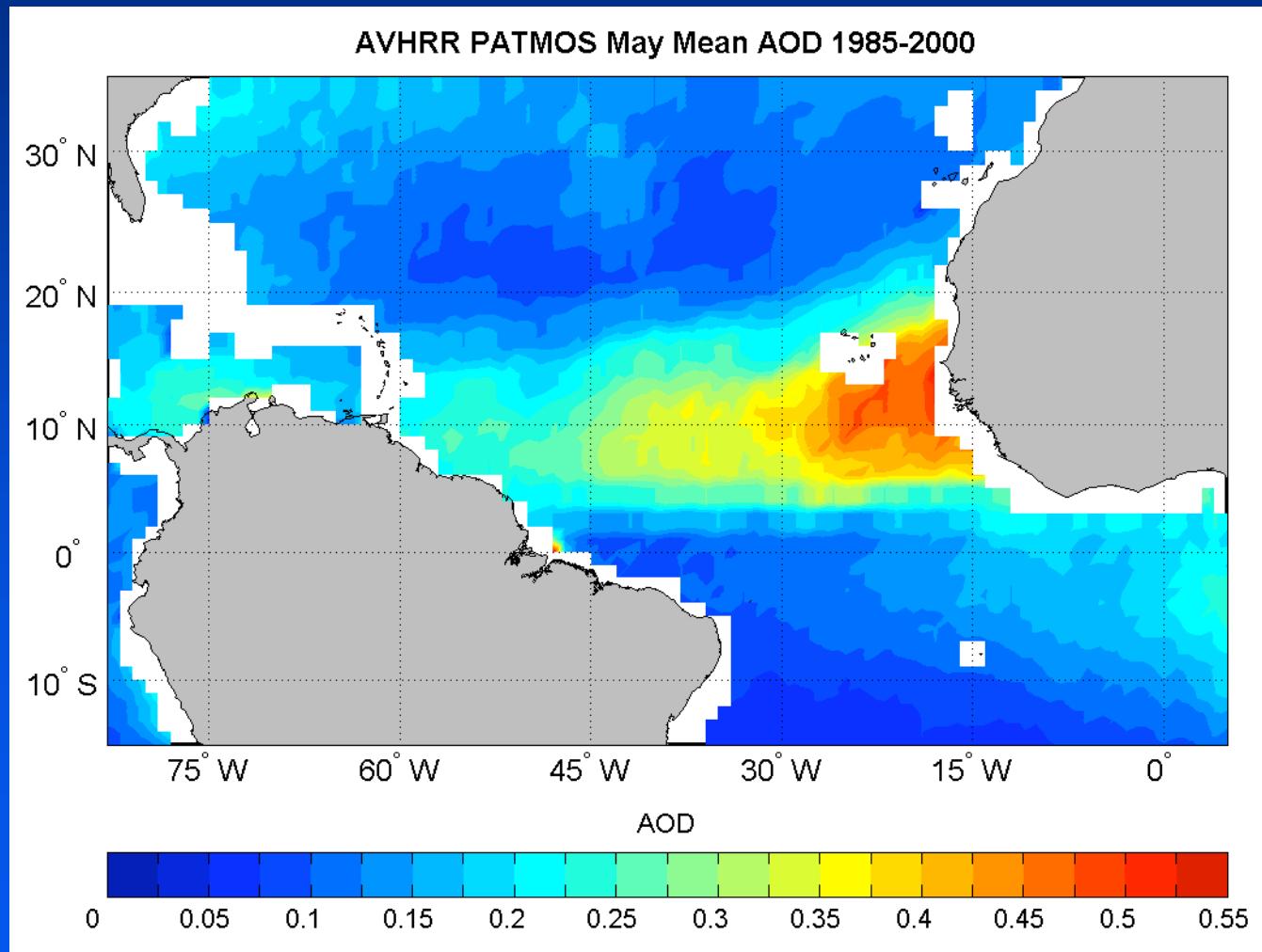


Instrumentation/Measurements



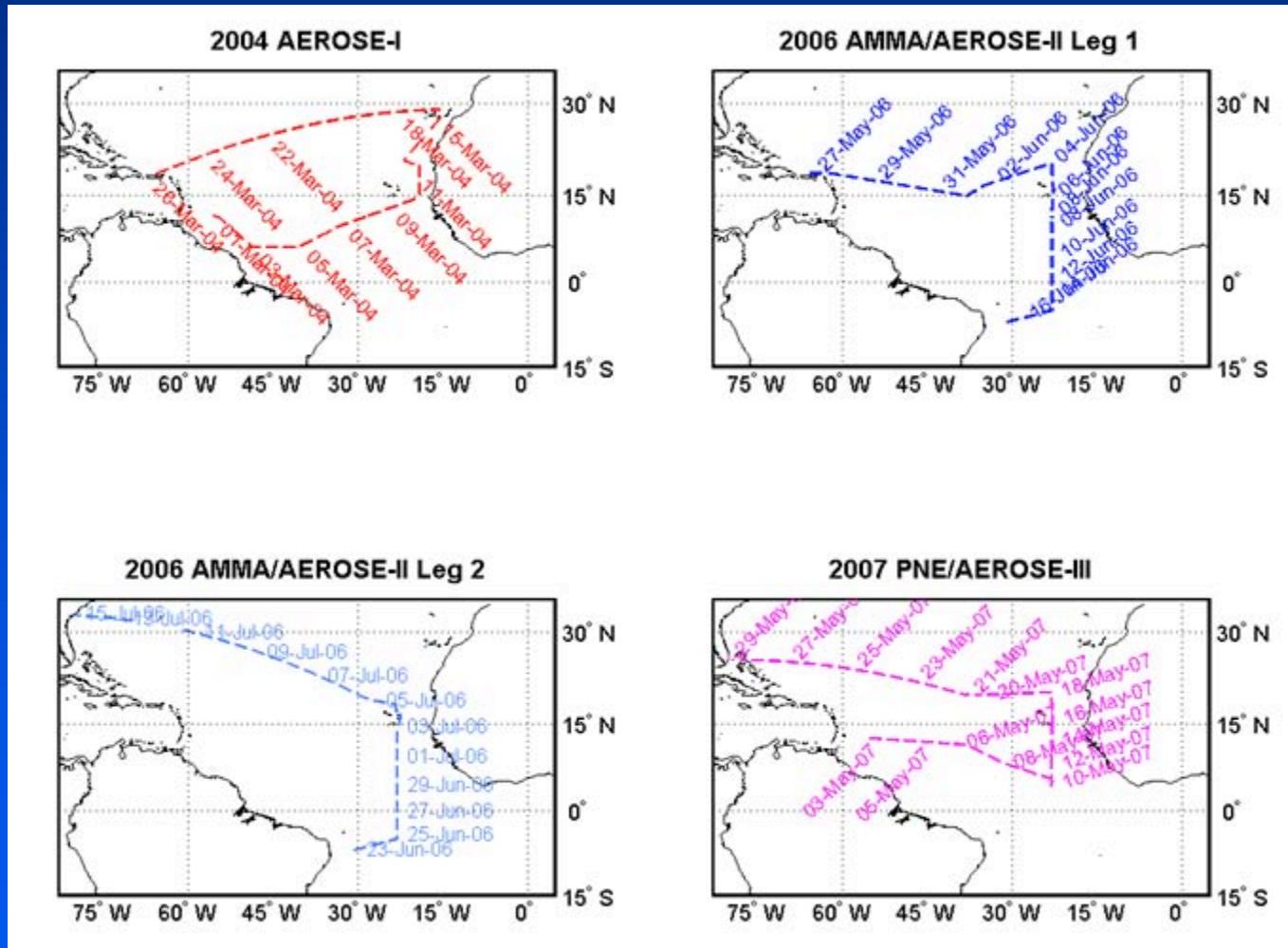
- Micropulse Lidar (MPL)
- Microtops sun photometer
- Vaisala RS92 Rawinsondes
- SciPump ECC-6A Ozone sondes
- M-AERI
- Cascade impactors
- PM10 high volume sampler
- Laser particle counter
- CTDs, XBTs
- MFRSR (shadowband radiometer)
- Microwave radiometer (integrated water)
- Broadband pyranometer
- *In situ* trace gases: O₃, CO, SO₂, NO_x
- Surface meteorological & oceanographic measurements

Satellite Aerosol Climatology - May



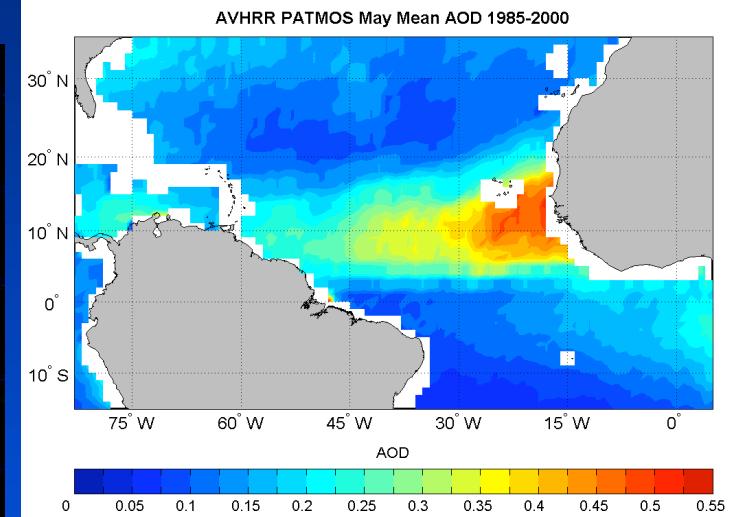
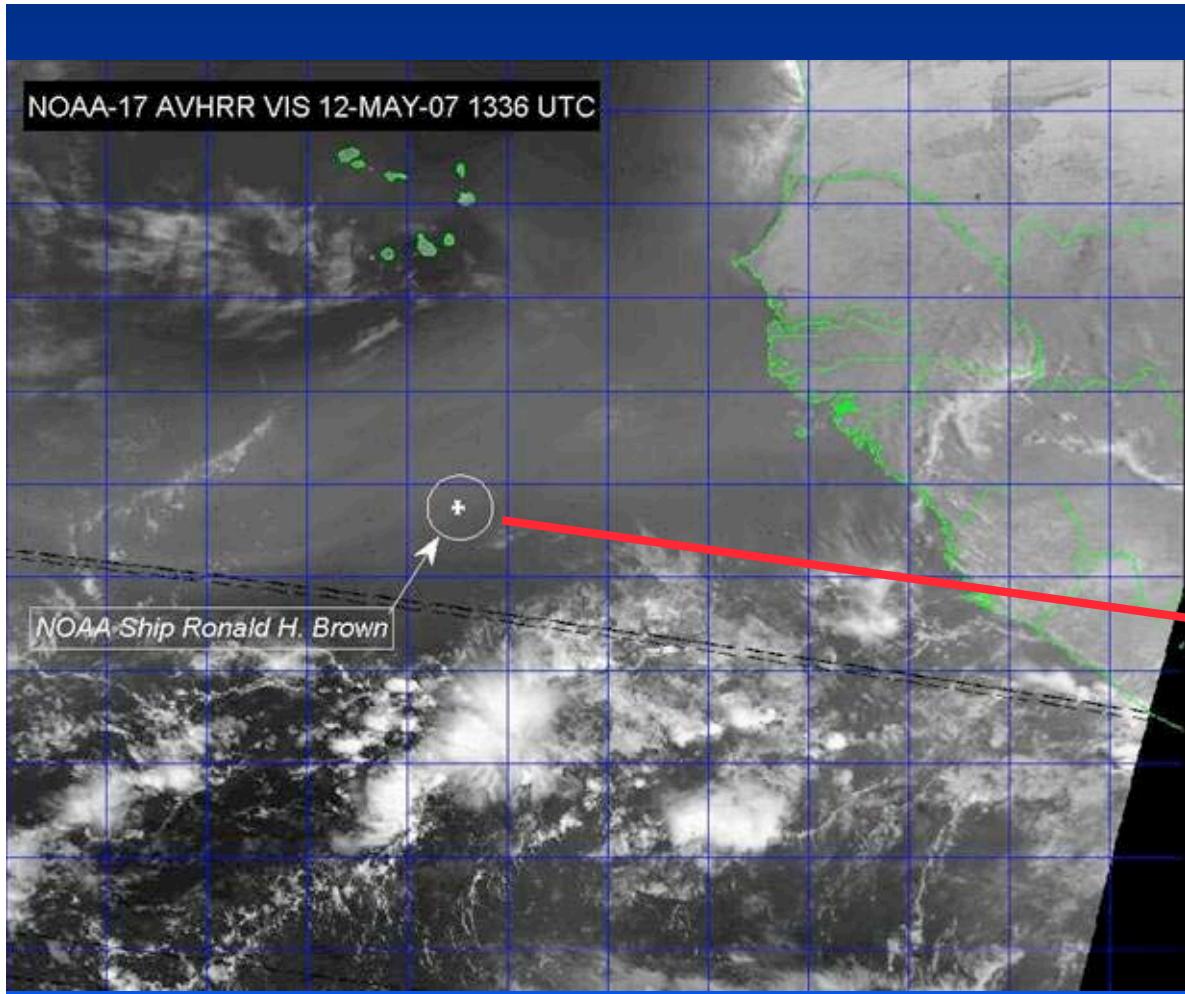


AEROSE Cruise Tracks to Date



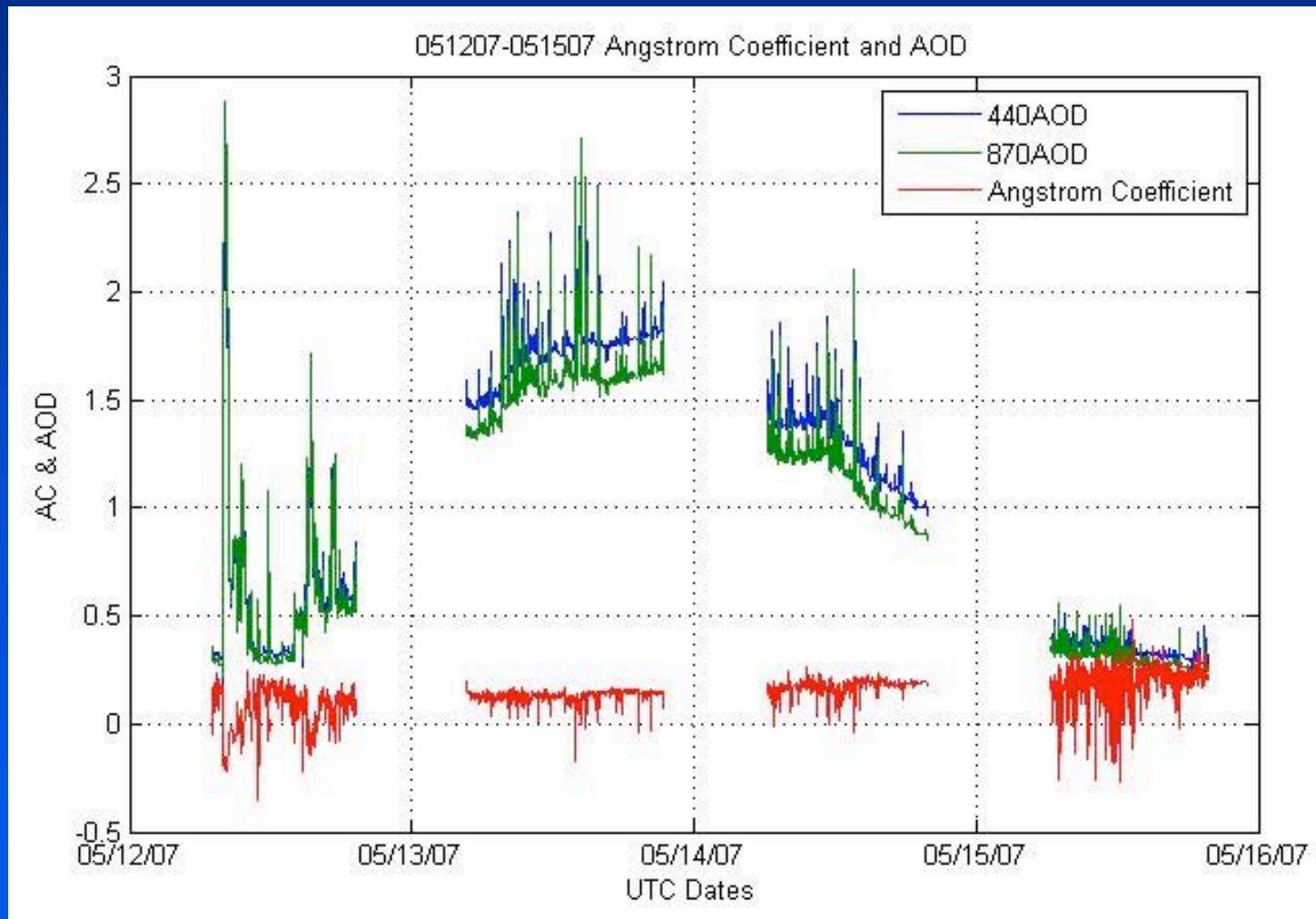


Dust Outflow Event - 12-15 May 07



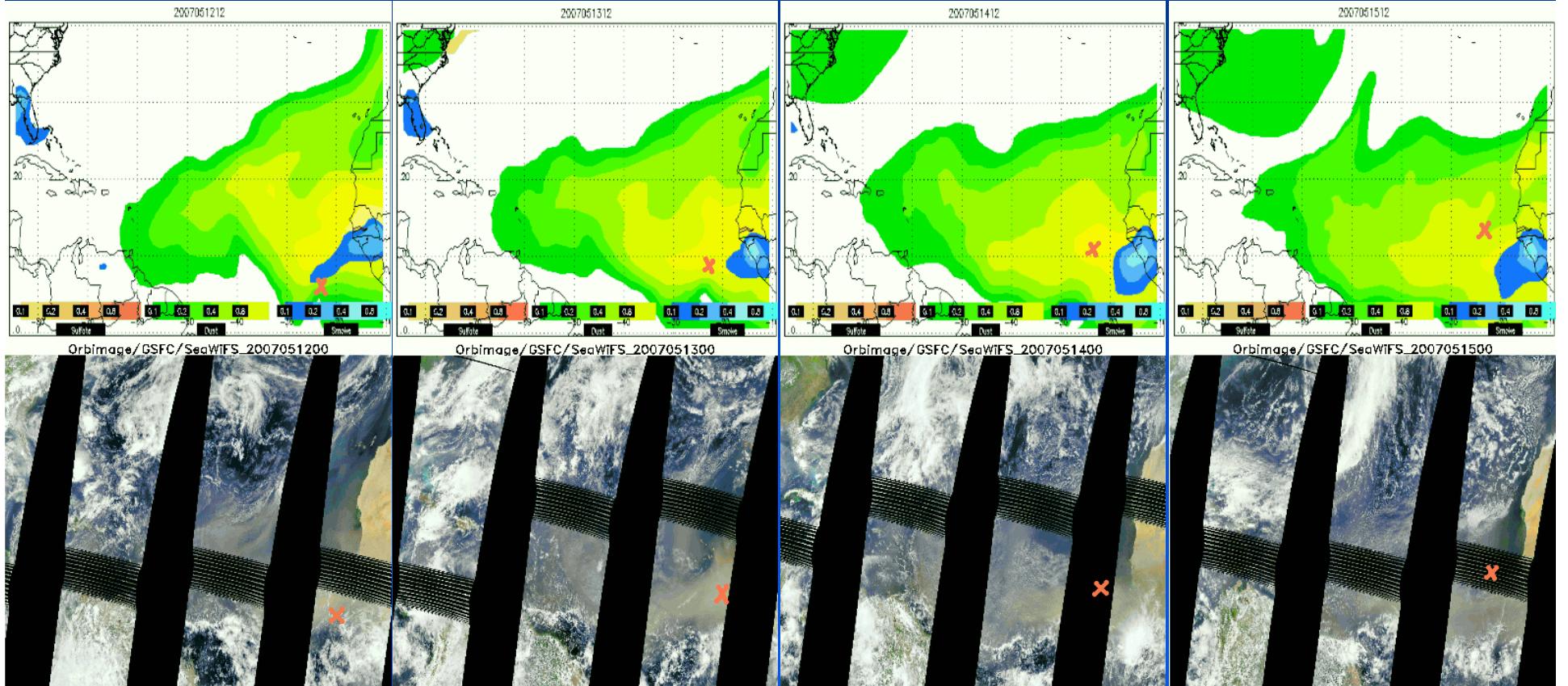


Microtops Optical Depths



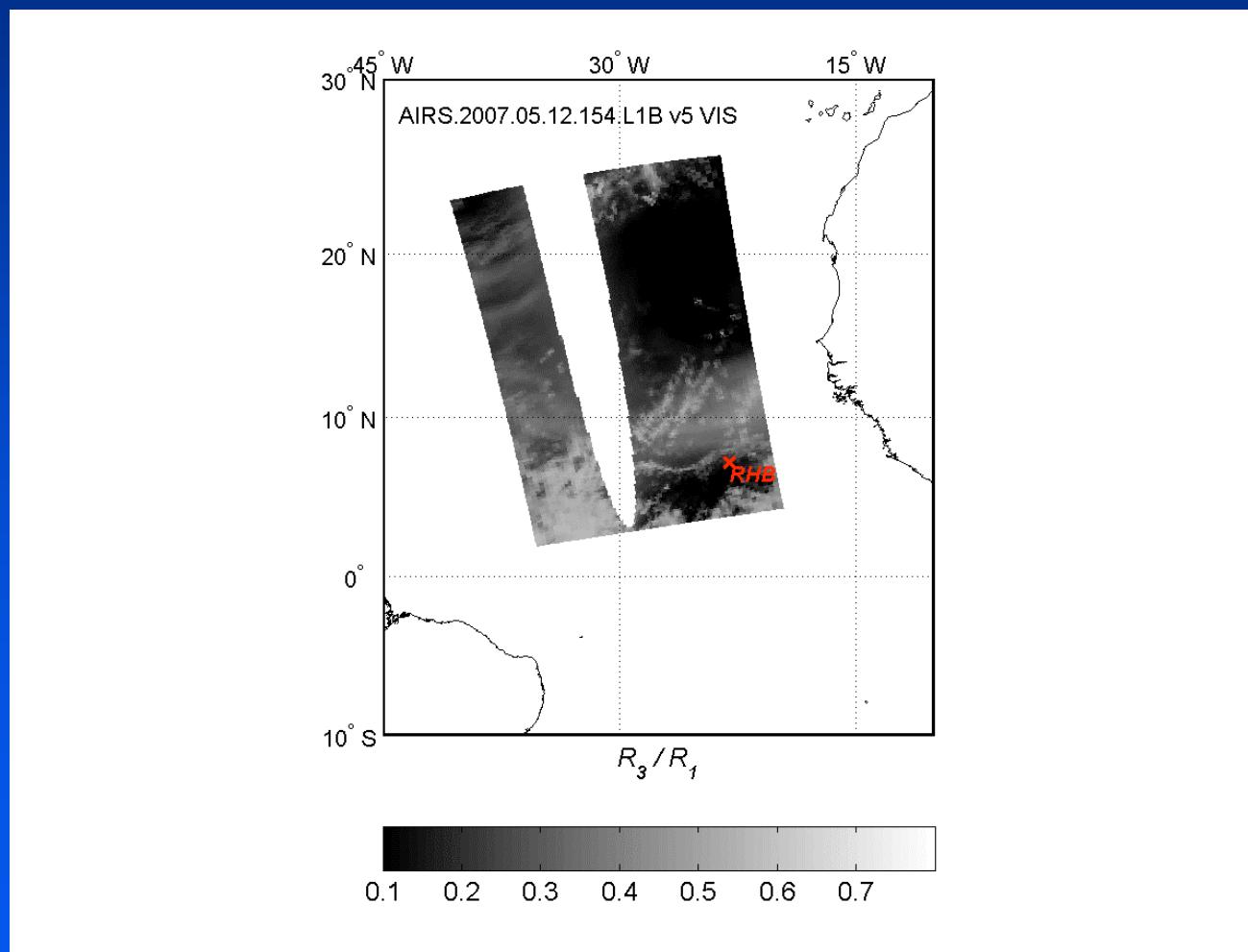


SeaWiFS and NAAPS Model During Dust Event



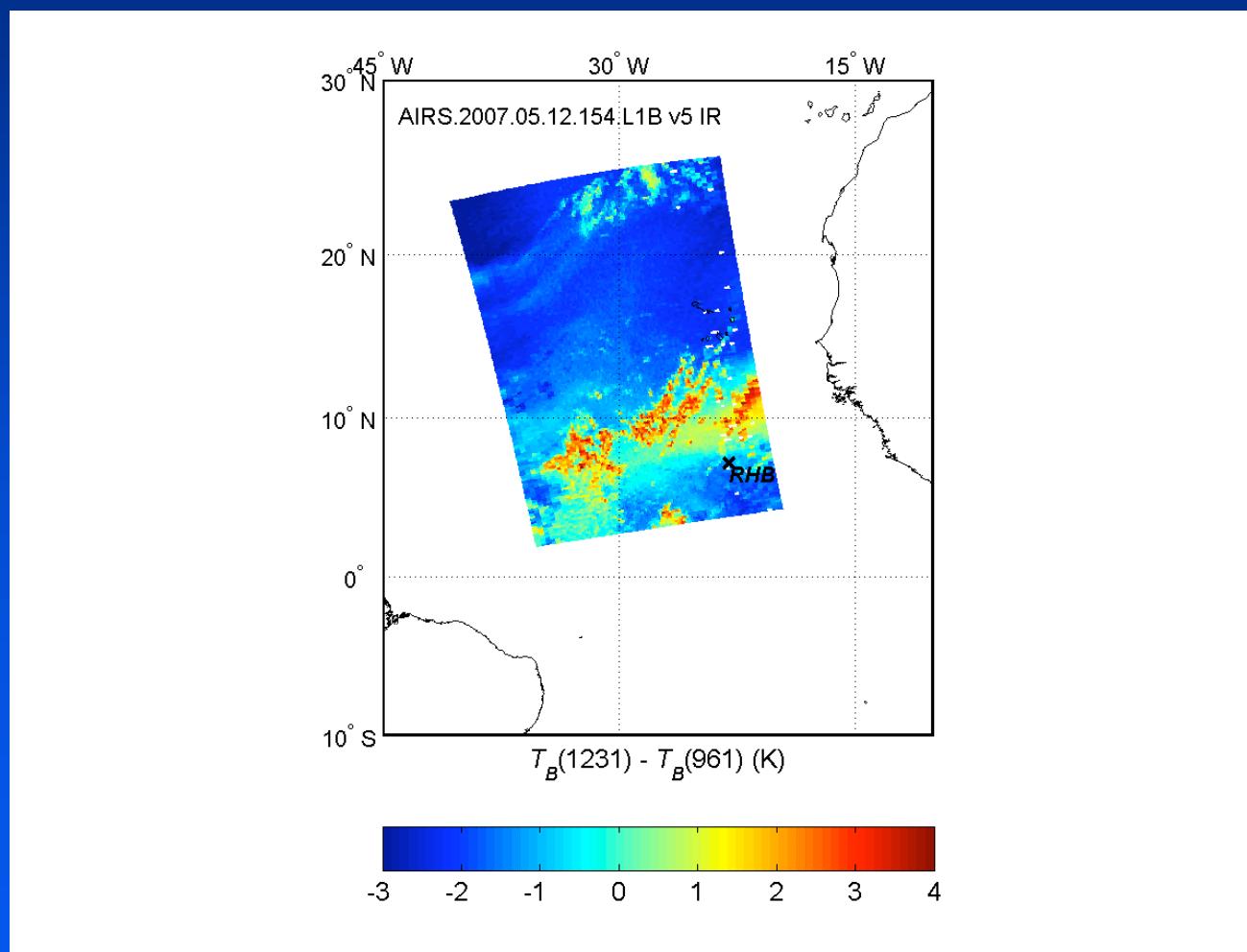


AIRS VIS R_3/R_1





AIRS 1231 – 961 cm⁻¹





Sondes

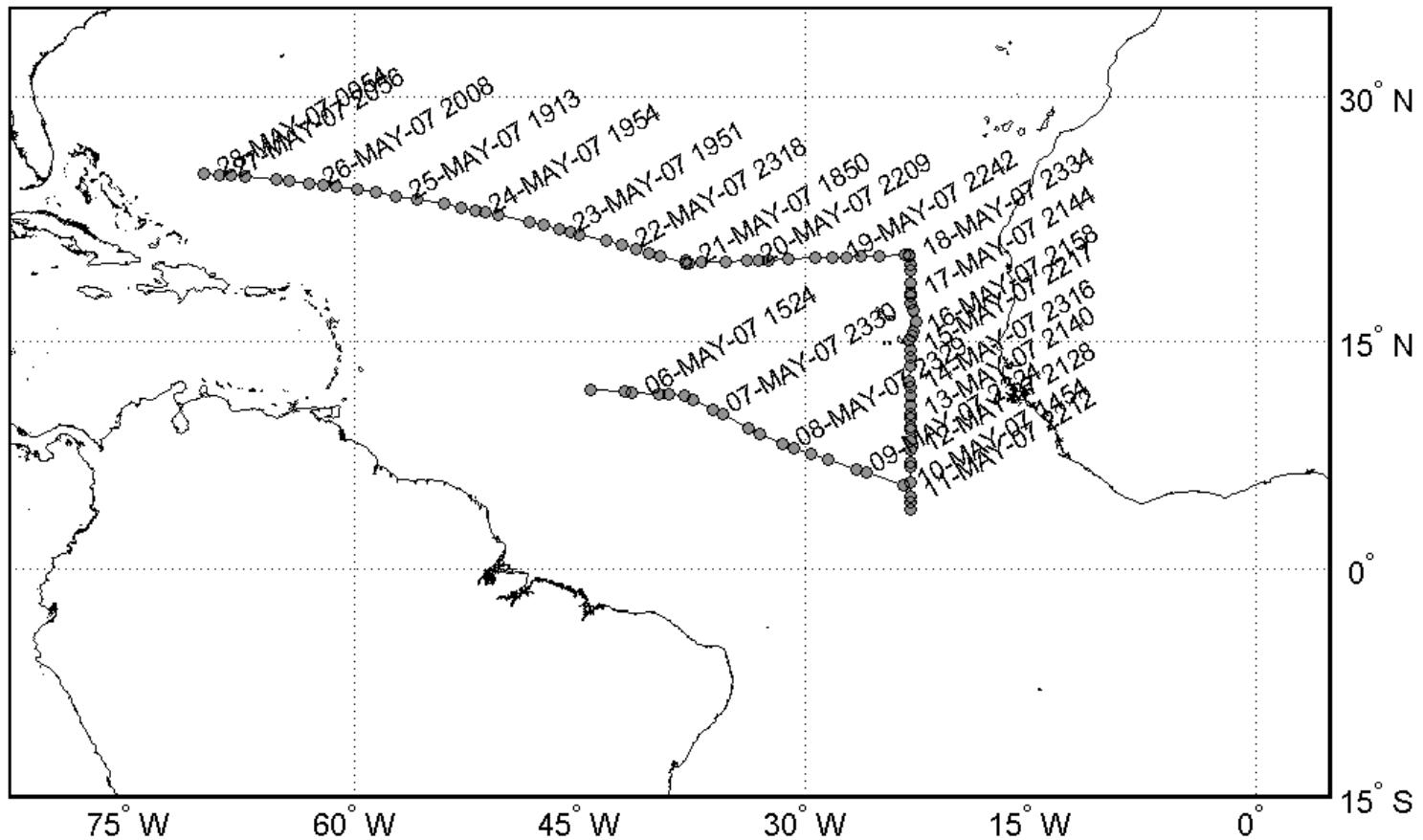
- **Vaisala RS92 GPS rawinsondes** were launched coinciding with AIRS and IASI overpasses (**96 total**)
- An Intensive Observing Period (IOP) along 23°W S-N transect
 - Sondes 4-5/day at ~01:30, 09:30, 13:30, 17:30, 21:30
- **Ozonesondes** ~1/day during S-N, E-W transects AIRS/IASI overpasses (**17 total**)



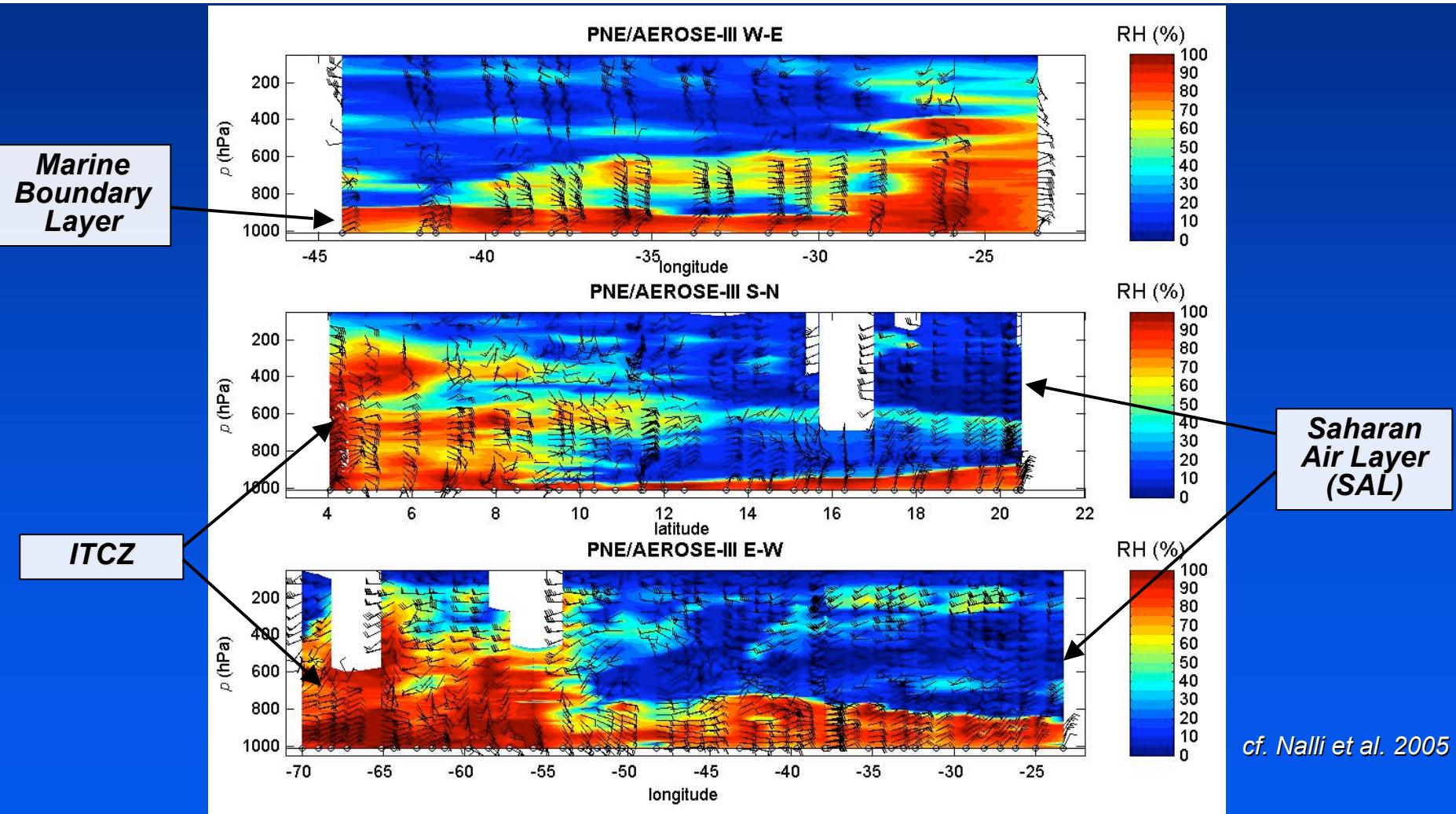


RS92 Launch Locations

PNE/AEROSE-III All Sonde Launch Locations



Relative Humidity Cross-Sections



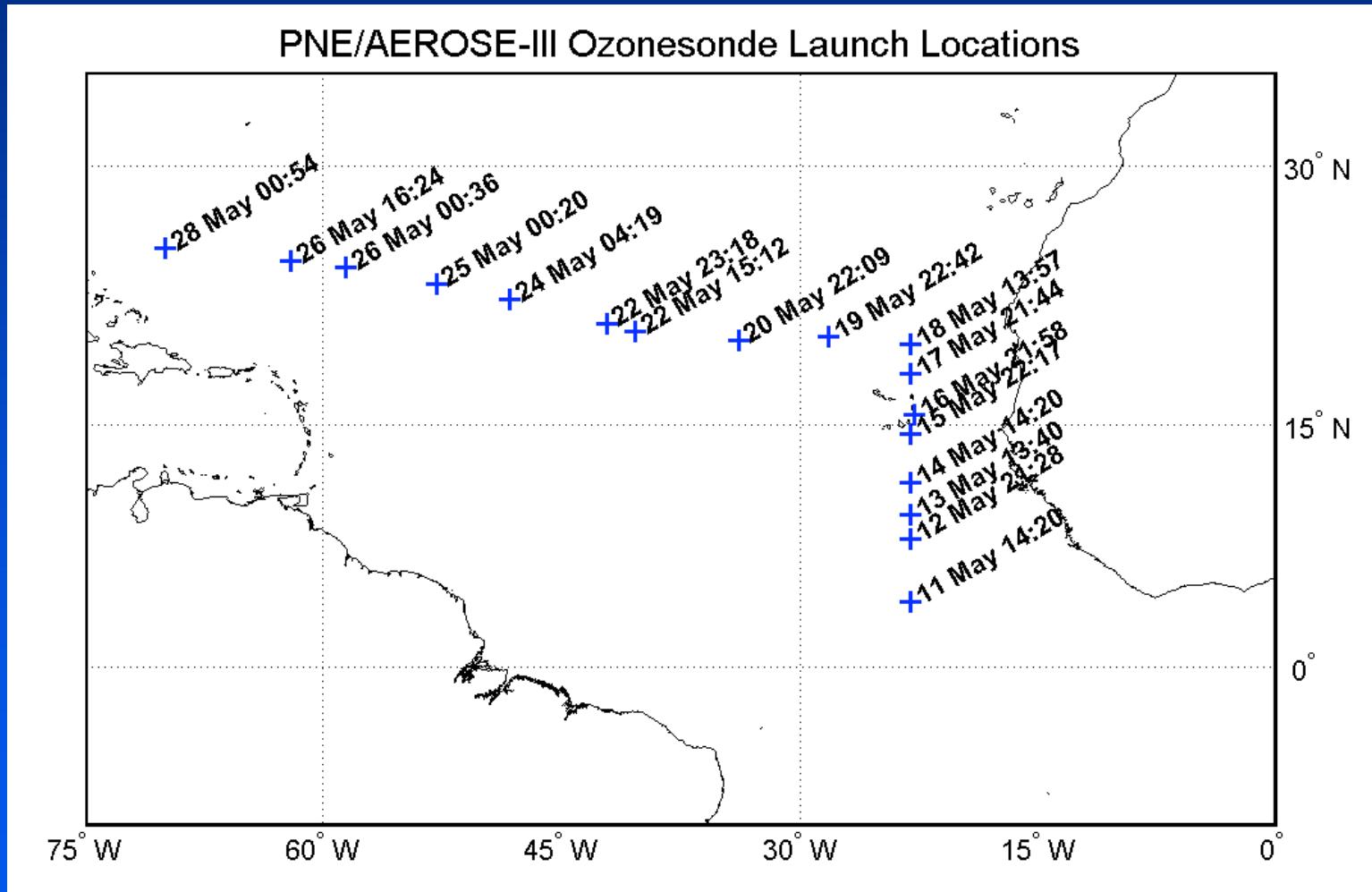


Ozonesondes





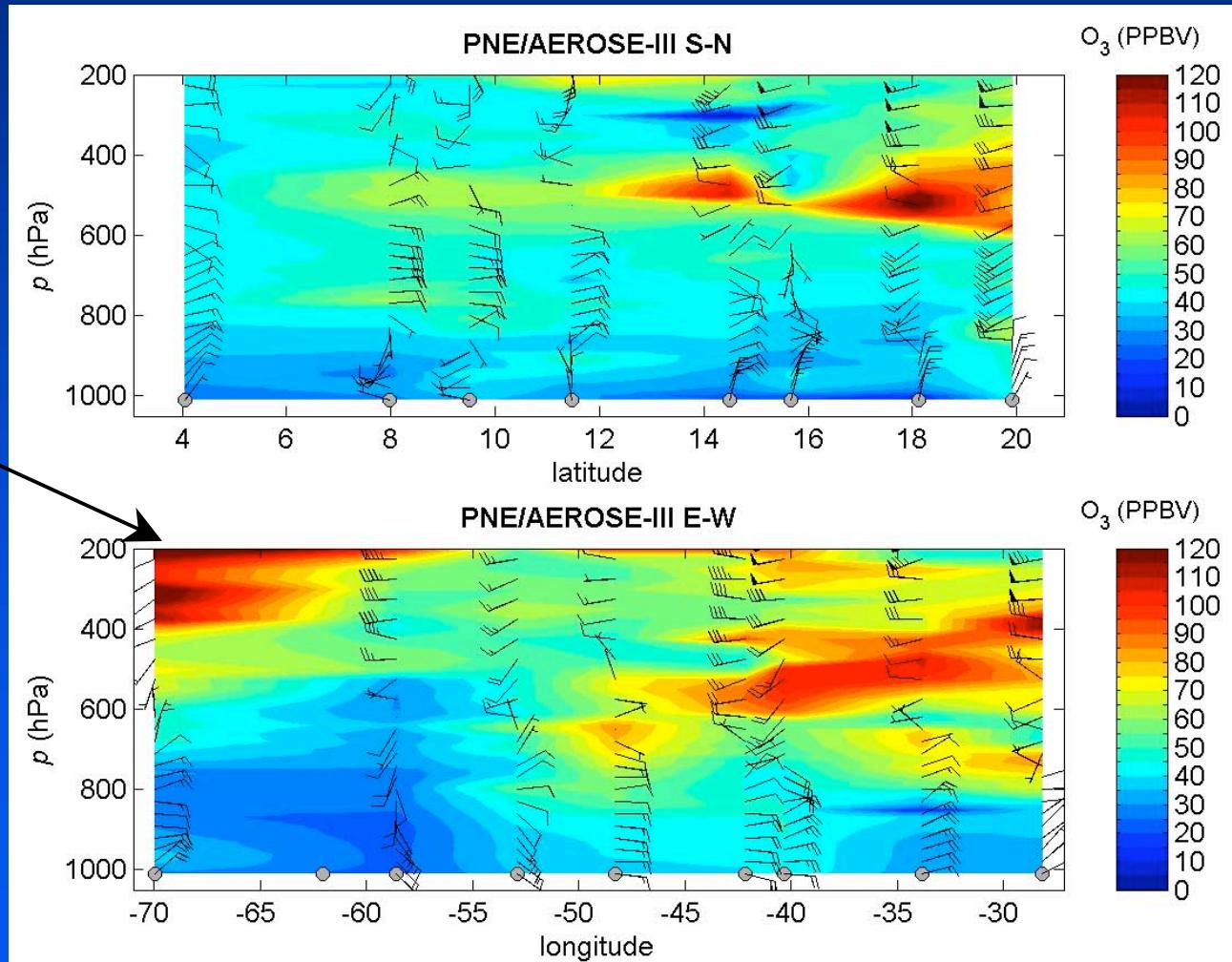
Ozonesonde Launch Locations





Ozone Cross-Sections

Possible
Stratospheric
Intrusions



Potential Satellite Validation



- **AIRS** and **IASI** (humidity, ozone, temperature soundings; skin SST)
- GOES-R ABI Legacy Sounding Products (via empirical proxy dataset)
- RTM w/scattering (e.g., aerosols)
- AURA/OMI (ozone profiles)
- AVHRR (SST, clouds, AOD)
- MODIS (aerosol, clouds, Chl-a, SST)
- SAR (winds, ocean features)
- TRMM (vertical precipitation profiles)



Summary

- The AEROSE-III piggyback combined atmospheric and oceanographic measurements acquired with a wide number of ship-based *in situ* and remote sensing sensors in an interdisciplinary fashion.
- The 2004, 2006 and 2007 cruise domains all spanned tropical Atlantic Ocean, a region of great interest in terms of the SAL, tropical storm formation, and tropospheric ozone/carbon/aerosol chemistry and transport.
- AEROSE intensive campaign data will used for AIRS/IASI validation activities in this otherwise challenging region.



Future Work

- Compilation of an AEROSE GOES-R Proxy Data Set, including SEVIRI, AIRS/IASI granules (w/ H. Xie, T. Zhu, W. Wolf)
- Ozonesonde and surface ozone analyses; Saharan air layer investigations using AIRS/IASI (w/ HU/NCAS)
- AIRS O₃ retrieval marine validation downwind of Saharan dust and biomass burning (w/ J. Wei, A. Gambacorta)
- AIRS/IASI/M-AERI temperature/H₂O profile validation (w/ UM/RSMAS)
- Aerosol retrievals/kCARTA modeling (w/ S. DeSouza-Machado and L. Strow)
- Continued participation in 2008 (and beyond) PNE Cruise piggyback opportunities (w HU/NCAS, UM/RSMAS, NOAA/)



Acknowledgements

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- **NASA's Tropical Center for Earth and Space Studies** of the University of Puerto Rico at Mayagüez (NCC5-518)
- We acknowledge the participation and support of all the **AEROSE Science Team members** and the many students who participated in the cruises.
- We also thank the **officers and crew of the *Ronald H. Brown*** for their support during 4+ weeks at sea.

